State of Missouri regional
COVID-19 hospitalized cases model

February 16, 2021

Multiple data points inform Missouri's COVID-19 response
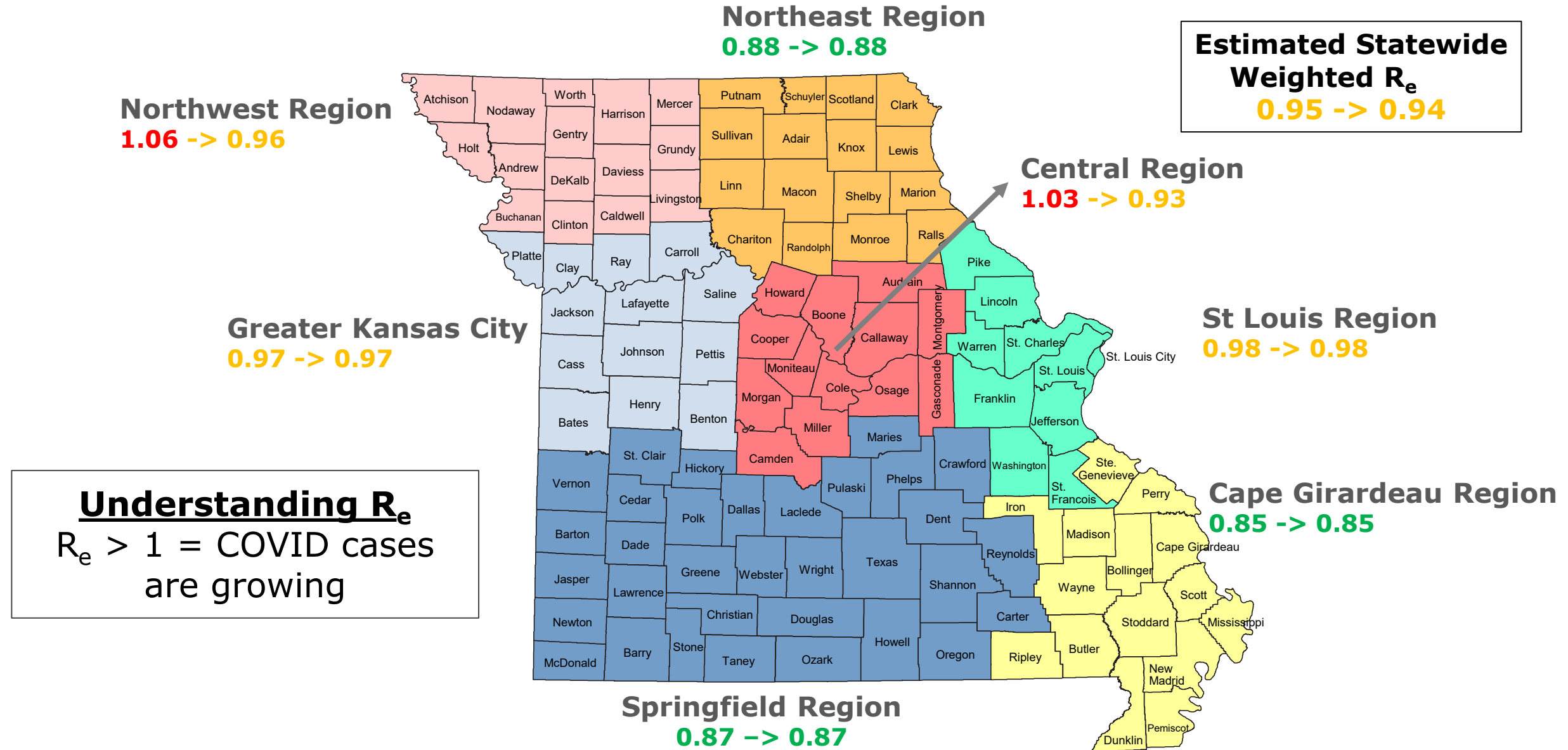
- Syndromic surveillance

- Healthcare system capacity (bed, PPE, and staff availability)

- Testing

- COVID-19 cases and deaths

- Economic and social impact

- Insights from U.S. states, nationally, and other countries

- Evidence from scientific literature

- Mathematical disease modelling

Our model estimates possible outcomes based on currently available information

What does the model tell us	What does it not tell us
Range of plausible outcomes based on our current knowledge of COVID-19 in Missouri	What will happen in the future
Approximate date and magnitude of peak/s based on current understanding of policy interventions and human behavior and assumptions about future interventions	Date and magnitude of peak/s if there are major changes in planned policy interventions and human behavior
Approximate estimate of effective transmission rate across a region	Exact transmission rate in all parts of a region — there may be areas of higher and lower transmission within the region
Projected hospitalizations for regions in MO with sufficient data, i.e. Kansas City Area, Central, St. Louis Area, Southeast and Southwest	Projected hospitalizations in regions where daily COVID-19 hospitalizations are fewer than 15 because insufficient cases

The ability to forecast depends on the quality and availability of data. For a new disease such as COVID-19, much remains uncertain.

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RECOVERY PLAN

Transmission rates ("R_e") drop below 1 in all Regions

Northeast Region
0.88 -> 0.88

Estimated Statewide Weighted R_e
0.95 -> 0.94

Northwest Region
1.06 -> 0.96

Central Region
1.03 -> 0.93

Greater Kansas City
0.97 -> 0.97

St Louis Region
0.98 -> 0.98

Cape Girardeau Region
0.85 -> 0.85

Understanding R_e
$R_e > 1$ = COVID cases are growing

Springfield Region
0.87 –> 0.87

Data date range: 02/9/21 – 02/15/21

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Central (Region F)

Overview

Population	502,486
Cumulative Cases	45178
Cumulative Deaths	555
7-day New Cases	314
WoW % Case Change	0.7%

Reproductive Rate

Pre-intervention	2.3
Last Week	1.03
Current Week	0.93
WoW % Change	-9.5%

Bed / Ventilator Availability

% ICU Beds Occupied	59%
% ICU Beds Occupied C19	5%
% ICU Beds Free	41%
% Ventilators in use	34%
% Ventilators available	66%

* % of occupied ICU beds taken by COVID-19 PUI/Confirmed patients

Base Case Central Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Mar 1, 2021, + 2 more

Hospitalizations

LEMMA Projections
median (best fit scenario)   p5   p25   p75   p95
Peak hospitalizations (best fit scenario)
Hospitalizations
Hospitalized COVID-19 cases (EMResource)   Hospitalized COVID-19 cases (NHSN)
Hospital Beds
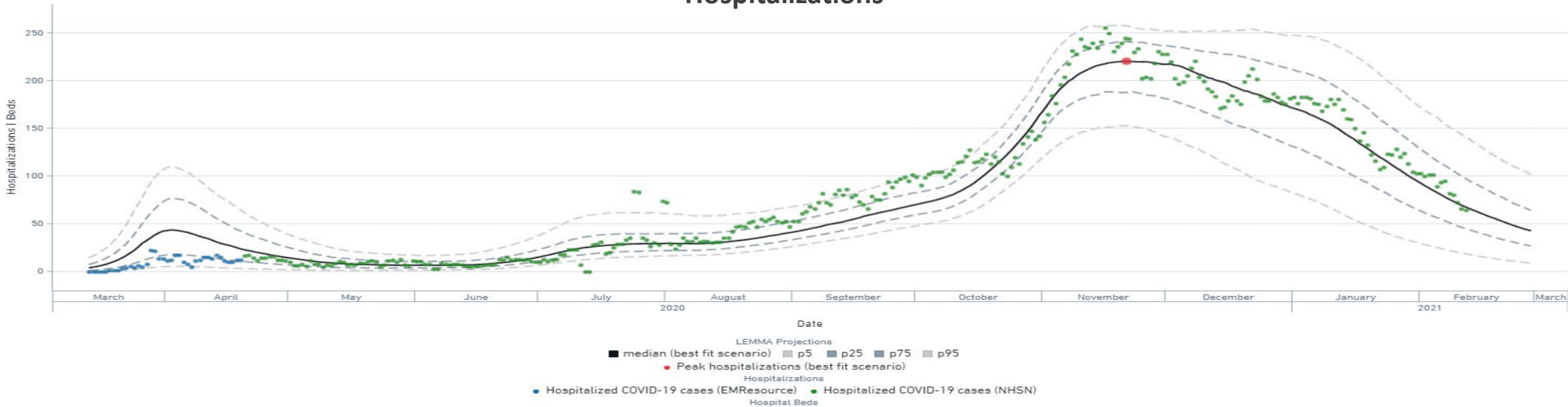
Greater Kansas City Area (Region A)

Overview	
Population	1,395,314
Cumulative Cases	103584
Cumulative Deaths	1399
7-day New Cases	1169
WoW % Case Change	1.1%

Reproductive Rate	
Pre-intervention	2.8
Last Week	0.97
Current Week	0.97
WoW % Change	0.1%

Bed / Ventilator Availability	
% ICU Beds Occupied	73%
% ICU Beds Occupied C19	12%
% ICU Beds Free	27%
% Ventilators in use	24%
% Ventilators available	76%

* % of occupied ICU beds taken by COVID-19 PUI/Confirmed patients

Base Case Kansas City Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Mar 1, 2021, + 2 more

Hospitalizations

LEMMA Projections
■ median (best fit scenario) □ p5 ■ p25 ■ p75 □ p95
● Peak hospitalizations (best fit scenario)
Hospitalizations
● Hospitalized COVID-19 cases (EMResource) ● Hospitalized COVID-19 cases (NHSN)
Hospital Beds

[Data updated 02/16/21]
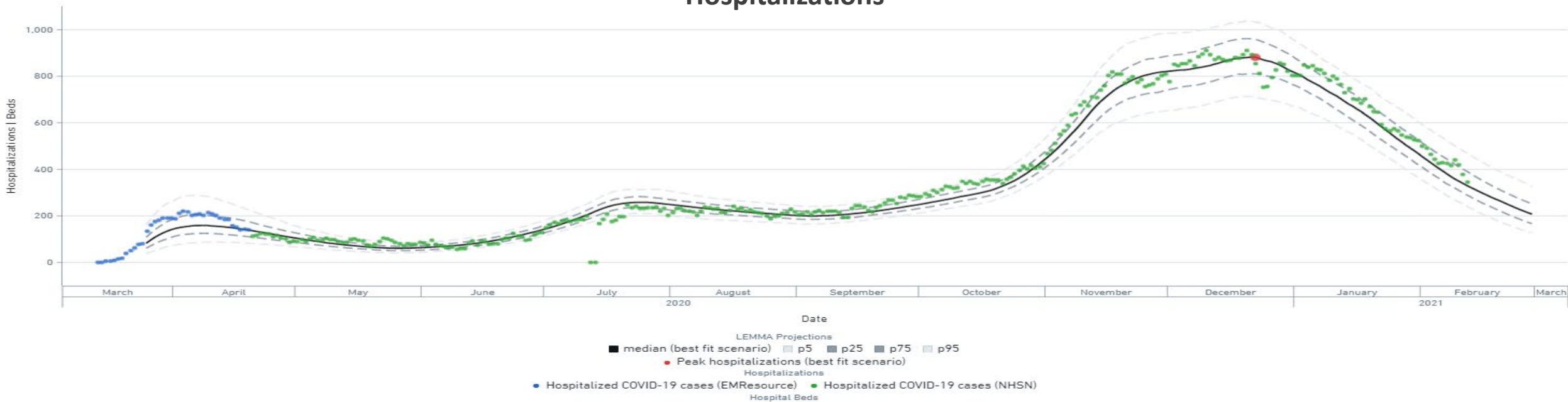
Northeast (Region B)

Overview	
Population	179,448
Cumulative Cases	13047
Cumulative Deaths	168
7-day New Cases	101
WoW % Case Change	0.8%

Reproductive Rate	
Pre-intervention	N/A
Last Week	0.88
Current Week	0.88
WoW % Change	0.2%

Bed / Ventilator Availability	
% ICU Beds Occupied	47%
% ICU Beds Occupied C19	8%
% ICU Beds Free	53%
% Ventilators in use	5%
% Ventilators available	95%

* % of occupied ICU beds taken by COVID-19 PUI/Confirmed patients

Base Case Northeast Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Mar 1, 2021, + 2 more

Hospitalizations

LEMMA Projections
median (best fit scenario) p5 p25 p75 p95
Peak hospitalizations (best fit scenario)

Hospitalizations
Hospitalized COVID-19 cases (EMResource)   Hospitalized COVID-19 cases (NHSN)
Hospital Beds

[Data updated 02/16/21]
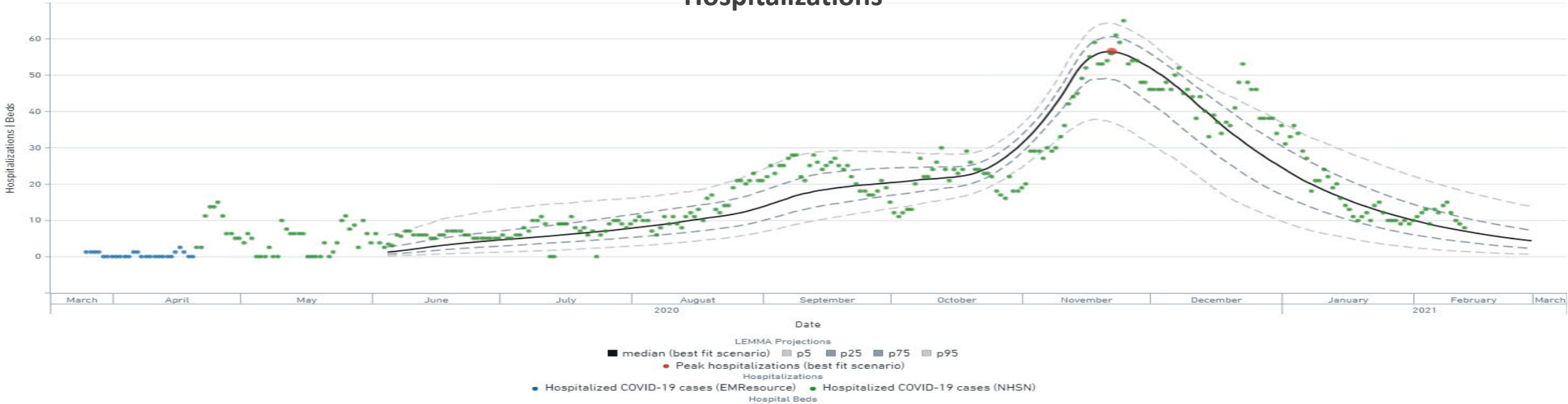
Northwest (Region H)
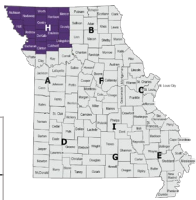
Overview	
Population	234,361
Cumulative Cases	18536
Cumulative Deaths	397
7-day New Cases	130
WoW % Case Change	0.7%

Reproductive Rate	
Pre-intervention	1.24
Last Week	1.06
Current Week	0.96
WoW % Change	-9.6%

Bed / Ventilator Availability	
% ICU Beds Occupied	81%
% ICU Beds Occupied C19	19%
% ICU Beds Free	19%
% Ventilators in use	19%
% Ventilators available	81%

* % of occupied ICU beds taken by COVID-19 PUI/Confirmed patients

Base Case Northwest Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Mar 1, 2021, + 2 more

Hospitalizations

[Data updated 02/16/21]
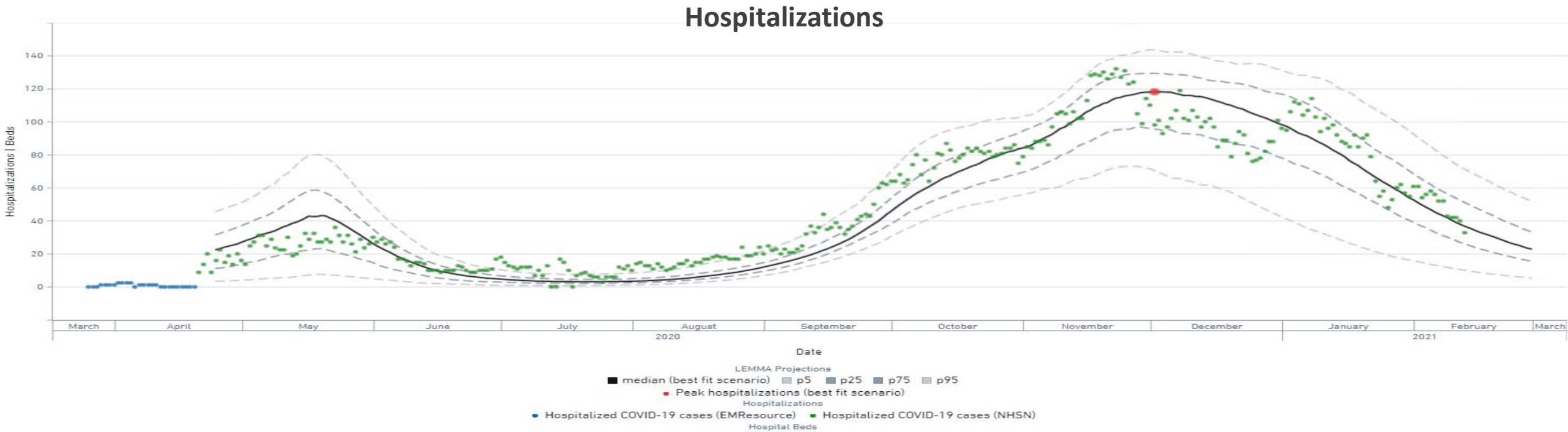
Southeast / Cape Girardeau (Region E)
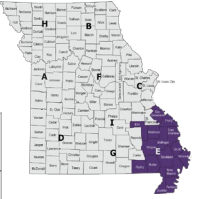
Overview	
Population	363,478
Cumulative Cases	31766
Cumulative Deaths	457
7-day New Cases	255
WoW % Case Change	0.8%

Reproductive Rate	
Pre-intervention	2.61
Last Week	0.85
Current Week	0.85
WoW % Change	0.5%

Bed / Ventilator Availability	
% ICU Beds Occupied	50%
% ICU Beds Occupied C19	11%
% ICU Beds Free	50%
% Ventilators in use	24%
% Ventilators available	76%

* % of occupied ICU beds taken by COVID-19 PUI/Confirmed patients

Base Case Southeast Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Mar 1, 2021, + 2 more

Hospitalizations

LEMMA Projections
■ median (best fit scenario) ■ p5 ■ p25 ■ p75 ■ p95
● Peak hospitalizations (best fit scenario)
Hospitalizations
● Hospitalized COVID-19 cases (EMResource) ● Hospitalized COVID-19 cases (NHSN)
Hospital Beds
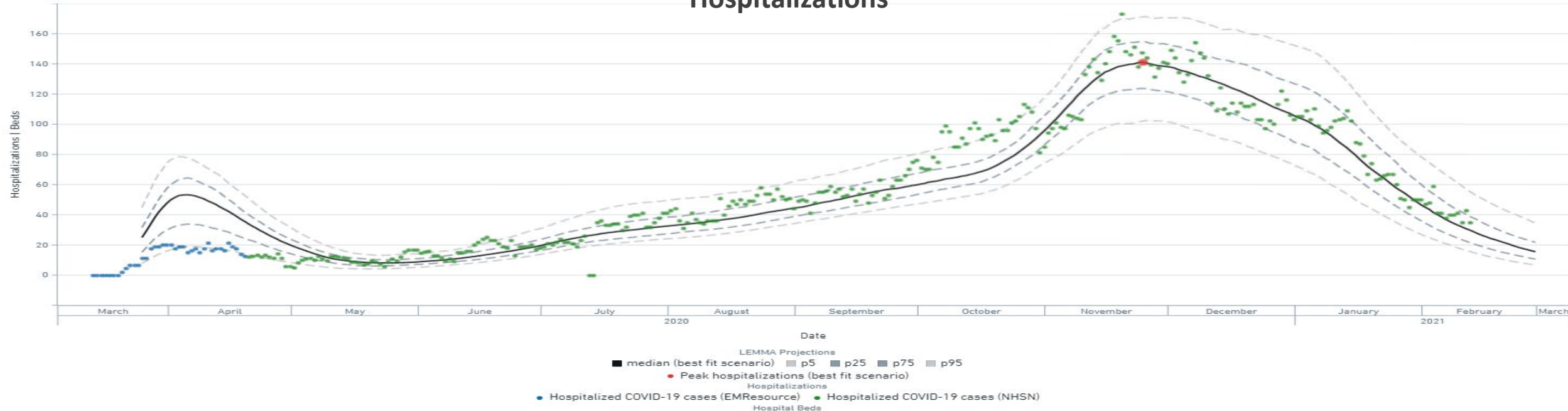
Southwest / Springfield (Regions D, G, I)
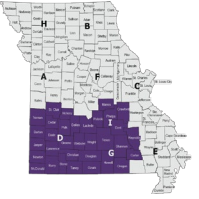
Overview	
Population	1,221,847
Cumulative Cases	90521
Cumulative Deaths	1607
7-day New Cases	908
WoW % Case Change	1.0%

Reproductive Rate	
Pre-intervention	2.36
Last Week	0.87
Current Week	0.87
WoW % Change	-0.2%

Bed / Ventilator Availability	
% ICU Beds Occupied	75%
% ICU Beds Occupied C19	14%
% ICU Beds Free	25%
% Ventilators in use	21%
% Ventilators available	79%

* % of occupied ICU beds taken by COVID-19 PUI/Confirmed patients

Base Case Southwest Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Mar 1, 2021, + 2 more

Hospitalizations

LEMMA Projections
■ median (best fit scenario) ■ p5 ■ p25 ■ p75 ■ p95
● Peak hospitalizations (best fit scenario)
Hospitalizations
● Hospitalized COVID-19 cases (EMResource)   ● Hospitalized COVID-19 cases (NHSN)
Hospital Beds
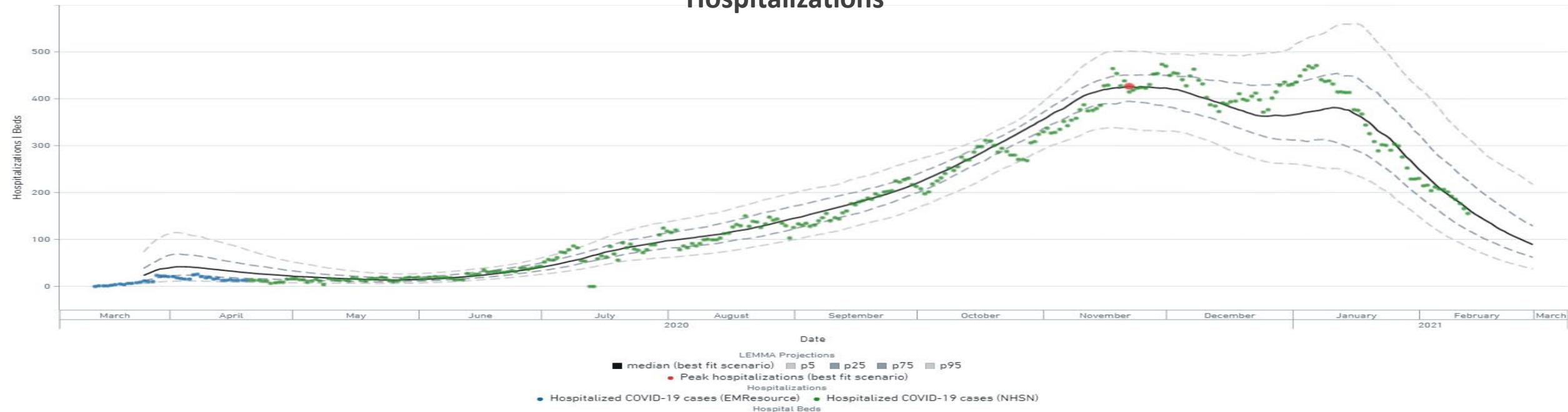
[Data updated 02/16/21]

Greater St Louis Area (Region C)

Overview	
Population	2,229,518
Cumulative Cases	168613
Cumulative Deaths	2872
7-day New Cases	2150
WoW % Case Change	1.3%

Reproductive Rate	
Pre-intervention	3.39
Last Week	0.98
Current Week	0.98
WoW % Change	0.3%

Bed / Ventilator Availability	
% ICU Beds Occupied	80%
% ICU Beds Occupied C19	11%
% ICU Beds Free	20%
% Ventilators in use	35%
% Ventilators available	65%

* % of occupied ICU beds taken by COVID-19 PUI/Confirmed patients

Base Case St. Louis Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Mar 1, 2021, + 2 more
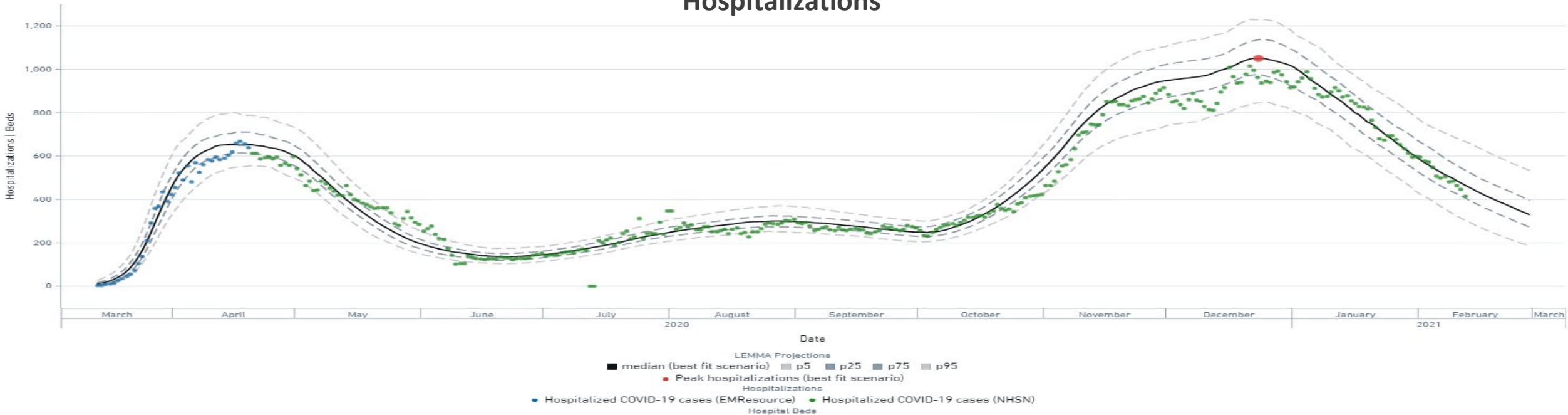
Hospitalizations

See FAQs for additional details

Link here: https://health.mo.gov/living/healthcondiseases/communicable/novel-coronavirus/pdf/modeling-faqs06032020.pdf

Regional COVID-19 transmission models help inform local policy, public health, and business decisions

- Mathematical models are commonly used to make projections of infectious disease epidemics (e.g., tuberculosis, HIV)

- Many sophisticated models on COVID-19 make global or national projections (e.g., Imperial College, Harvard, IHME)

- However, these generally do not incorporate critical local or regional inputs, such as:
  - Variations in local population size and age structure
  - Date and nature of social distancing and other policies

- Regional projections are important because:
  - Regional epidemics may differ markedly from the national average
  - Policy response occurs at state, county, and municipal levels

State of MO, WUSTL, and MHA have developed a regional model of hospitalized COVID-19 cases

- **Standard SEIR model that combines universal characteristics of COVID-19 infection (e.g., transmission parameters) with local inputs to support regional decision making**
  - Mathematical model developed by experts from UMass Amherst, UC Berkeley, UCSF, and WUSTL
  - Uses a statistical approach that adjusts underlying parameters as new data are observed

- **Customized using the latest local data from Missouri's emergency response regions, including:**
  - COVID-19 positives and PUIs
  - Population and age structure
  - Policy interventions
  - Avg. hospital length of stay

- **Projects COVID-19 hospitalized cases** to directly address the question of hospital capacity and provide a more accurate picture on COVID-19's impact on the healthcare system

Model Structure (SEIR)